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Characterization of Maxillary Sinus in Patients with Facial Pain using Ultrasound

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Abstract- *Objectives:* This study dealt with characterization of maxillary sinus in patients with facial pain using ultrasound.

Methods: It was carried out on 50 patients complaining of maxillary sinus problems who were referred to the National Center of Ear, Nose and Throat Khartoum-Sudan. The instruments used were; Aloka SSD 500, Honda HS2000 portable with curvilinear probe 3.5MHz, and General ElectricLOGIQ5 Mobile with curvilinear and linear probe (3.5MHz, 10MHz).

Results: patients were 27males (54%) and 23 females (46%), their ages ranging between (20-70 years) and the most affected age group was the range (20-30years). All of them were of maxillary pain (100%), 28 patients (56%) of halitosis, 29 (58%) postnasal drip, 30 (60%), stuffy nose, 27 (54%) fever and 17(34%) with of malaise. All patients were diagnosed previously by computerized tomography(CT)coronal scans. Ultrasound findings in the maxillary sinuses of the patients were 30% polyps with hypo echoic cavity, 12% fluid with hypo echoic cavity and the posterior margin was seen, 2% showed cyst with hypo echoic area and well defined borders,12% mucosal thickening, 38% normal sonographic appearance of hyper echoic anterior wall and cavity and the posterior margins were not seen, 6% polyps mucosal thickening with hypo echoic cavity with echogenic bony walls.

Keywords : *ultrasound, pain, maxillary sinuses.*

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Characterization of Maxillary Sinus in Patients with Facial Pain using Ultrasound

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Conclusion: The study concluded that the ultrasound has sensitivity of 76.6% and specificity of 92.2% and ultrasound is beneficial in diagnosis of maxillary sinus pathology and could be used as one of the diagnostic imaging modality ,as it is non invasive ,easy and with no radiation hazards.

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I. Introduction

Sinusitis is one of the most common problems affecting the maxillary sinuses. Acute sinusitis may be caused by bacterial infection; Complications of acute bacterial sinusitis (ABRS) may include orbital, intracranial, or soft tissue involvement. Therefore, accurate diagnosis is of major importance and the radiographic imaging is considered as an accurate diagnostic tool.[1]

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The American Academy of Pediatrics Clinical Practice Guideline on the management of sinusitis stated that imaging including radiographs, Computerized Tomography(CT) or magnetic resonance imaging(MRI) ;can serve only as confirmatory measures of sinus disease in patients whose clinical histories are supportive of the diagnosis [2]. The American Academy of Allergy, Asthma and Immunology stated that computed tomography (CT) is the preferred imaging technique for pre-operative evaluation of the paranasal sinuses and that ultrasonography has limited utility, but may be applicable in pregnant women and for determining the amount of retained secretions [3]. Coronal computed tomography (CT) scan of the paranasal sinuses was suggested to be considered in the diagnosis of acute sinusitis [4]. The diagnosis of both acute and chronic sinusitis should be made clinically, and not on the basis of imaging findings alone. CT remains the study of choice for the imaging evaluation of acute and chronic sinusitis, in addition magnetic resonance imaging of the sinuses, orbits, and brain should be performed whenever extensive or multiple complications of sinusitis are suspected. In chronic sinusitis, CT scanning is the "gold standard" for the diagnosis and the management, as well as when surgery is necessary. Nuclear medicine studies and ultrasound are rarely indicated in acute and chronic rhinosinusitis [5]. Diagnostic ultrasound is a non-invasive imaging modality that uses high-frequency sound waves. The great variability of test performance of diagnostic ultrasound in acute sinusitis cites systematic evidence [4]. No risks have been identified with ultrasound evaluation of the paranasal sinuses, but the accuracy of the ultrasound is dependent largely on the examiner's skills.[6]

Therefore this study is to assess the role of ultrasound as another tool in diagnosis of maxillary sinuses in patients with facial pain in order to take part in the detection of maxillary sinuses disorders as well as to characterize normal echo texture of different maxillary sinuses diseases as compared to CT; and to correlate between the ultrasound findings with the patients clinical findings.

II. Material and Methods

The study was conducted at the National Center of Ear, Nose, Throat (ENT) and Head and Neck surgery Khartoum-Sudan, in the period from August to November 2011.

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a) Study sample

The sample size consisted of 50 Sudanese patients (females and males) between 20 to 70 years old complaining of maxillary pain, and different clinical symptoms. They were previously diagnosed by CT scan and then were investigated by ultrasonography . Patients whose ages less than 20 years old, and more than 70years old, and patients who have no previous CT scans were excluded. No identification or individual details were published.

b) Instrumentations

Ultrasound machines used were Aloka SSD 500 portable with curvilinear probe 3.5MHz, Honda HS2000 portable with curvilinear probe 3.5MHz and General Electric LOGIQ5 Mobile with curvilinear and linear probes (3.5MHz-10MHz).

c) Method

An approval from the review board and ethics committee of the College of Medical Radiological Science was taken .The patients were examined in sitting position; the U/S gel was applied to the area on the face where the sinuses are located, including the nose, cheekbones and maxillary sinuses. High frequency sound waves produced the image of the internal structures, and a highly ultrasound expertise Ear, Nose, Throat(ENT) specialist doctor had done the scan and interpreted the data .The patients were scanned by a frequency ranging from 3.5 to 10 MHz. The data were collected using variable patients complaints and they were diagnosed by U/S and the findings were correlated to CT findings.

To find out the accuracy, sensitivity and specificity of ultrasound(U/S) as compared to the Computed Tomography (CT) diagnosis; equations were applied including :A)For U/S accuracy (True positive cases(TP) +True negative cases(TN) /Total number of cases) X 100.B) For U/S Sensitivity(True positive cases(TP) /True positive(TP) +False negative(FN)X100. C) for U/S specificity (True negative cases(TN) /True negative cases(TN) +False positive cases(FP) X100.

III. Results

The following results were for a sample consisted of 50 patients (23 females and 27 males) all were complaining of maxillary pain. The patients were classified according to age. Patients ages ranged from 20-30 years were 21(42%), 31-40years14(28%), 41-50years5(10%), 51-60 3(6%) years, 61-70 7(14%) (Figure1). The following tables showed the results according to the age, gender, complaints and the ultrasound findings.

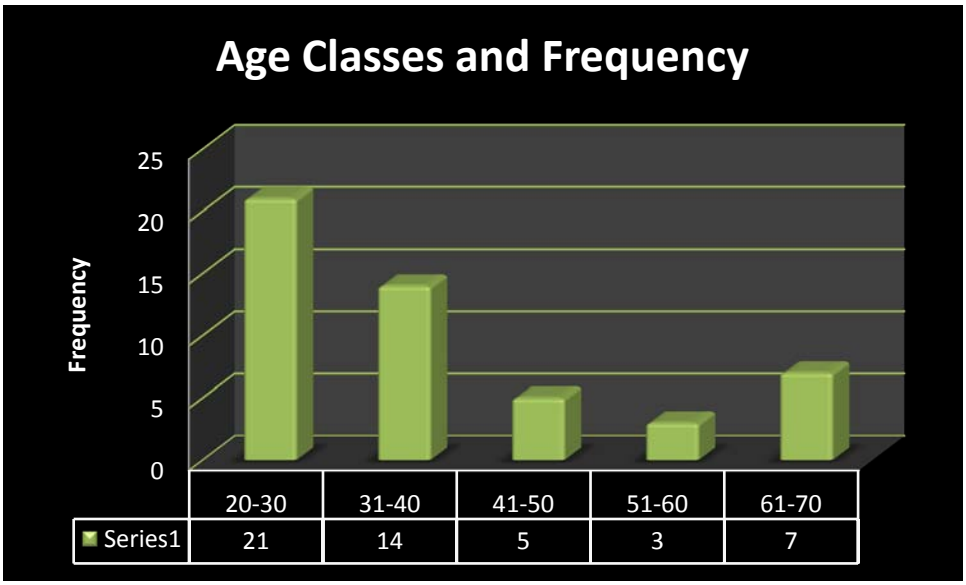

Figure 1 : Age Classes and Frequency

Table 1 : Shows the frequency and percentage of symptoms in the study population

Complains	Number of patients (%)
Fever	27 (54%)
Malaise	17 (34%)
Stuffy nose	30 (60%)
Post nasal drip	29 (58%)
Halitosis	28 (56%)
Pain	50 (100%)

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Table 2 : Shows frequency distribution and percentage of ultrasound diagnosis

Ultrasound diagnosis	Frequency (%)
Fluid	6 (12%)
Polyp	15 (30%)
Cyst	1 (2%)
Mucosal Thickening	6 (12%)
Normal	19 (38%)
Polyploidy mucosal thickening	3 (6%)
Total	50 (100%)

Table 3 : Shows the frequency of ultrasound findings according to the patient's gender

Gender	Fluid	Mucosa Thickening	Normal	Polyps	Cyst	Polyploidy mucosal thickening
Male	4	2	12	9	0	0
Female	2	4	7	6	1	3
Total	6	6	19	15	1	3

Table 4 : Comparison of Diagnosis of Maxillary sinuses using Ultrasound and other similar studies

Auther	Ultrasound Sensitivity	Ultrasound Spesifity	Modalities used	Number of Patients
Current Study	76.6%	92.2%	CT and Ultrasound	50
Apostolos H. et al [7]	66.7%	94.9%	CT and Ultrasound	56
Fufezan et al [8]	94.9%	98.4	X-Rays and Ultrasound	67

IV. Discussions

In recent decade, the Health Care Guideline (2011) stated that the diagnosis of acute sinusitis should be based on the presenting symptoms, history, and clinical examination. It noted that plain X-rays for sinus and other imaging tests are usually not necessary in making the diagnosis of acute sinusitis due to their poor sensitivity and specificity limits. Other published studies of ultrasound of the paranasal sinuses do not permit assessment of the sensitivity or specificity of the technique compared to the gold standard of CT scanning. [9]

The Agency for Healthcare Research and Quality (AHRQ) evidence report on Acute Bacterial sinusitis does not address ultrasound of the sinuses [10]

This study assessed the ultrasonography as another tool in the diagnosis of maxillary sinuses disorders in patients with pain in order to analyze whether ultrasonography with a reasonable degree of confidence and can replace radiography in the diagnosis of sinusitis. Fifty patients from the national center of ENT diseases and head and neck center who were previously diagnosed by CT, were investigated by ultrasound, the study showed different maxillary sinus ultrasound diagnosis related to age, gender and complaints.

The frequency distribution was according to gender (table 3), there were 27 males (54%) and 23 females (46%) out of total 50 patients (100%) with maxillary sinus pain. These results support the fact that the males were more affected than females.

The study showed the frequency and percentage regarding to age group (Figure1), the most affected age group was the group (20-30) years constituting 42%.

The frequency and percentage of the patient's complaints (table1) revealed that 50/50 (100%) complain of pain followed by stuffy nose 30/50 (60%) as compared to the other complaints.

The frequency distribution and percentage of ultrasound diagnosis (table 2), clarifies that the normal U/S appearance was found in 19/50 constituting 38%, followed by polyps, mucosal thickening and cysts.

Ultrasonography character and findings of the maxillary sinuses were 30% polyps with hypo echoic cavity, 12% fluid with hypo echoic cavity with posterior margin was seen, 2% cyst with hypo echoic area with well defined borders, 12% mucosal thickening, 38% normal sonographic appearance of hyper echoic anterior wall and cavity and the posterior margins were not seen, 6% polyploidy mucosal thickening with hypo echoic cavity and echogenic bony walls.

From the study, the patients suffered from maxillary pain represented (100%), halitosis (56%), stuffy nose (60%), postnasal drip (58%), fever (54%), and malaise (34%).

When comparing the Ultrasound findings with the CT findings; the study showed that the ultrasound has Sensitivity of 76.6% and specificity of 92.2%

Regarding the results and comparing to what was mentioned by (AHRQ); Ultrasound is proposed for demonstrating mucosal wall thickening, focal soft tissue

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masses, and complex collections in the paranasal sinuses.

Ultrasound is a painless non-invasive diagnostic procedure and no risks have been identified with ultrasound evaluation of the paranasal sinuses, but the accuracy of the ultrasound is dependent largely on the examiner's skills and to achieve this purpose; this study was done by a highly experience ENT specialist with ultrasongraphy of excellent performance. The study concluded that paranasal sinus ultrasound has been proposed as best diagnostic imaging modality to confirm the diagnosis of clinical sinuses diseases.

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